

COLLEGE OF PHARMACY

Master of Science in Pharmaceutical Sciences

PROGRAM OBJECTIVES

The major focus of the Master of Science in Pharmaceutical Sciences (MSPS) program is to provide students with a strong research focus, training and skills in order to prepare them for careers in academia, the pharmaceutical industry, or public/private research.

PROGRAM OVERVIEW

A minimum of 40 semester credit hours is required for completion of the MS program. This includes 20 hours of didactic study and 20 hours of research credits, leading to a thesis. The program emphasizes research in the pharmaceutical sciences.

PROGRAM FACULTY

Program faculty are part of the Department of Pharmaceutical Sciences in the College of Pharmacy. Their areas of research emphasis include pharmacology, pharmaceuticals, pharmacokinetics, drug metabolism, genomics, toxicology, and molecular immunology.

APPLICATION AND ADMISSIONS REQUIREMENTS

Graduates with a bachelor of science degree in pharmacy, chemistry, biology or related scientific area are eligible for admission in the program.

Minimum criteria to receive consideration for admission follow. Meeting these criteria, however, does not guarantee admission into the program.

- A completed Western University of Health Sciences Graduate Application form (including all supplemental information for international applicants).
- Official transcripts of all undergraduate and graduate coursework with an overall GPA of 2.50 or greater on a 4-point scale.
- Applicants who wish to use course work completed outside the United States must submit transcripts for evaluation to one of the following services:

World Education Services P.O. Box 745 Old Chelsea Station New York, NY 10113-0745 (212) 966-6311 www.wes.org	Educational Credential Evaluators, Inc. P.O. Box 514070 Milwaukee, WI 53203-3470 (414) 289-3400 www.ece.org
Josef Silny & Associates 7101 SW 102 Avenue Miami, FL 33173 (305) 273-1616 www.jsilny.com	International Educational Research Foundation, Inc. P.O. Box 3665 Culver City, CA 90231-3665 www.ierf.org

A course-by-course evaluation is required, and all course work must be designated as undergraduate, graduate or professional. Western University will only honor evaluations from one of the above services. The evaluation must be included with the application packet.

- Official test scores for the general aptitude portion (verbal, quantitative, and analytical) of the Graduate Record Examination (GRE) taken within the last five (5) years, with a score of greater than or equal to 1000 on the combined verbal and quantitative.
- Three letters of reference from individuals familiar with the applicant's scholarship and research potential.
- All applicants submitting course work from foreign schools are required to pass English language requirements before they are eligible for financial assistance. A minimum score of 89 on the Internal Based TOEFL (iBT) is required (minimum 23 Speaking, 22 Writing and 22 Listening). Only iBT scores less than 2 years old from the application deadline will be considered.

Application Deadline:

Applications must be received (including all supporting application materials) no later than September 1 for the spring semester (January) and March 1 for the fall semester (August). Completed application that arrive before the deadline may be considered on a rolling basis.

TUITION AND FEES

In estimating costs for one academic year of study at Western University of Health Sciences' MSPS program, you should include tuition and fees, laptop computer and printer, books and supplies, room and board, and other miscellaneous expenses. Actions of the Board of Trustees setting tuition and fees for the academic year are established during the previous spring term. The most current tuition and fees are as follows (subject to change):

- Tuition - \$660 per credit hour in 2011-2012 Academic Year.
- Other Mandatory fees specific to the College of Pharmacy will be provided separately.
- Application Fee - Non-refundable \$40 fee for those applying to the Western University MSPS program.

Other Fees

\$300	Graduation Fee (assessed on candidates for graduation only)
\$400	(annual) Western University Parking Permit Fee (Optional)
\$30	(per day) Late Registration Fee
\$40	Lost Mail Locker Key
\$10	(each) Copy of Official Transcript
\$21	(each) Rush Transcript, First Class Mail
\$25	(each) Rush Transcript, Federal Express
\$10	Lost ID Badge
\$0.25	(per page) Copy of Student File Material (replacement cost) Breakage Fee

FINANCIAL SUPPORT

Financial support, which includes a stipend and full payment of tuition, is available to qualified applicants on a limited, competitive basis in the form of teaching and research assistantships. Support is for 12 months (including summers) and is limited to a total of two consecutive years for any student.

Students may also receive a travel stipend, which allows for travel to a national meeting.

ACADEMIC POLICIES AND PROCEDURES**Program Outcomes**

- 1. Critical Thinking:** The MSPS graduate will be able to identify and understand critical issues in pharmaceutical sciences. They should possess the ability to challenge and evaluation information using evidence-based research principles, as well as synthesize and integrate knowledge in the discipline, leading to new ideas, approaches and research.
- 2. Breadth and Depth of Knowledge:** The MSPS graduate will understand the current and historical theories, concepts, and models of pharmaceutical sciences. They should possess the ability to access and evaluate the literature of the discipline and understand the major issues in the current state of knowledge. They should also possess an ability to transcend traditional disciplinary boundaries and effectively conduct original, discovery-based or applied research in pharmaceutical sciences under the direct guidance of a faculty member.
- 3. Interpersonal Skills:** The MSPS graduate will possess the ability to write and speak about the current issues of pharmaceutical sciences to peers, practitioners and the public. They should be able to articulate and demonstrate knowledge of the discipline and write and present scholarship to professionals.
- 4. Collaboration Skills:** The MSPS graduate will be able to collaborate with other members of the research team, with colleagues (both within the discipline and across related disciplines), and if appropriate, with other communities of interest in the conduct of a research program.

- 5. Ethical and Moral Decision Making (Humanistic Skills):** The MSPS graduate will understand and exhibit the professional standards for responsible and ethical conduct of research in pharmaceutical sciences.
- 6. Life-Long Learning:** The MSPS student should be able to engage in life-long, self-directed learning to maintain and expand competence in the discipline, including staying abreast of current issues, methods and approaches in pharmaceutical sciences.
- 7. Evidence-Based Research:** The MSPS student will have a solid grounding in the literature pertaining to a particular question and be able to understand and appropriately use the methods and techniques of advancing knowledge in their field of study. They should be capable of designing, working within, and coordinating multi-disciplinary research programs.

Faculty Advisor and Thesis Advisory Committee

The faculty advisor serves as the Chair of the student's Thesis Advisory Committee and helps the student in his/her choice of electives and research projects/thesis topic. Further, the advisor may also assist the student in obtaining a research assistantship if funds are available. The Chair is responsible for the satisfactory academic progress of the student, and must hold committee meetings with the student on a regular basis.

Students will be assigned a faculty advisor prior to admission to the program, and must remain with that advisor for the duration of the degree program. The thesis advisory committee consists of at least three faculty members (the faculty advisor plus two other faculty). The Chair and at least two of the committee members must be full-time faculty in the Department of Pharmaceutical Sciences at the Western University of Health Sciences College of Pharmacy. Upon approval by the Department Chair, a fourth member from outside of the department may be eligible for appointment to the committee.

Thesis

The thesis will be based on a research project that the student will undertake during the MS program. The faculty advisor will help the student select a topic and mentor the student in his/her progress.

MS candidates are required to present a written report of the thesis and present it to the thesis advisory committee for approval. In addition, students will be required to defend their theses via an oral presentation of the thesis content at the end of the program. The oral defense may also include questions based on the required course work completed by the student. The defense committee will consist of the thesis committee and an external member from within the Western University of Health Sciences faculty, whose role will be to ensure that the defense is conducted fairly.

All candidates must pass a comprehensive examination covering the major and minor field, as well as the research and thesis. This usually is a two-hour oral examination. Members of the university faculty not on the thesis advisory committee may attend any oral examination as visitors. The faculty advisor will schedule the oral examination no later than the date of the deadline set by the Department Chair. Successful completion requires the unanimous support of all members of the thesis advisory committee. If a student fails the oral examination, on re-examination may be accorded the student based upon the recommendation of the thesis advisory committee and approval of the Department Chair. Further re-examination may be allowed only under exceptional circumstances and only with the approval of the Department Chair and the Dean of the College of Pharmacy.

Upon satisfactorily passing all examinations, students are to provide 7-8 professional printed copies of their thesis for their committee members (3-4 copies), the department (1 copy), and the university library (2 copies).

A fee will be charged to the student for microfilming his/her thesis.

Grading System

Official grades are turned in to the Registrar from the College of Pharmacy Dean, at which time the online student records system, BanWeb, is updated. Official grade reports and unofficial transcripts will be available on the BanWeb student records system throughout the academic year. For more information on how to access the BanWeb student records system, visit the Registrar's website at <http://www.westernu.edu/registrar>.

Western University of Health Sciences makes use of letter grades, which may include a plus/minus (+/-) system of grading. The MSPS program makes use of letter grades only. A four-valued letter grade scale will be given, indicating:

Grade	Quality Points
A - Excellent	4
B - Good	3
C - Satisfactory	2
U- Unsatisfactory	0
I- Incomplete	0
Au - Audit	0
W- Withdrawal	0
M- Missing	0
CR - Credit	0
NCR - Non-credit	0

Courses are rated at one semester hour for each 12 contact hours. The grade point average is calculated at the end of each semester as the sum of earned grade points divided by the sum of semester hours passed and failed. A cumulative grade point average will be calculated and posted on the transcript.

No grade will be changed unless the instructor certifies in writing that an error in computing or recording the grade has occurred or that the student has completed course requirements for an Incomplete grade or remediated an Unsatisfactory grade.

Withdrawing from Courses

Courses may be dropped without academic penalty on or before end of the third week of the semester. A course may be dropped after the third week of the semester only under unusual conditions. When the Department Chair approves dropping the course under such circumstances, a “W” will be assigned for the course.

Incomplete

An Incomplete grade (“I”) will only be assigned to students whose professional commitments and/or personal responsibilities prevent him or her from completing the requirements of the course. A student may remove an incomplete by completing course requirements within the following six calendar months or the final grade will be permanently recorded as a “U”. This rule applies regardless of the student’s enrollment status. A student not enrolled during the following six months must still successfully remove the “I” grade. The instructor must certify any grade changes. The I grade will remain on the student’s transcript, along with the final grade assigned by the instructor.

Academic Standing

Only grades in Western University of Health Sciences courses approved for graduate credit will be used in determining the overall grade point average for continuation in the MSPS program. If, at the end of any semester, the cumulative grade point average falls below 3.0, the student will be placed on academic probation, and financial support will be discontinued. A 2.0 (“C”) grade earned in any class may be applied toward graduation only if the overall grade point average at the time of application for graduation continues at a minimum 3.0 (“B”) cumulative grade point average. Any grade below a 2.0 (“C”) may not be applied toward graduation.

Dismissal

If the cumulative grade point average remains below a 3.0 after the student completes a total of 9 (nine) graded credit units subsequent to being placed on academic probation, the student will be dismissed from the program. The student may be readmitted only after completion of a remediation plan recommended by the Thesis Advisory Committee. No course work taken as part of the remediation plan will be counted toward the MSPS degree or incorporated into the student’s cumulative grade point average. Graduate level courses for which grades below “C” were earned may not be repeated during the remediation period.

Graduation Requirements

For successful completion of the MSPS program, the faculty of the College of Pharmacy has established guidelines and requirements in addition to the courses and optional requirements listed above. Minimum requirements for graduation with an MS include:

- a. A minimum grade of 2.0 in each graduate course taken as part of the program.
- b. Overall 3.0 GPA of course work taken in the program
- c. Satisfactory completion and oral defense of a written thesis as well as satisfactory completion of all approved coursework.
- d. Attendance at the commencement ceremony during which time the degree will be awarded. Requests to be excused from this requirement must be submitted in writing to the President and approved subject to whatever additional stipulations the President shall make.
- e. All financial and other obligations to the University have been met.

No student may graduate until all “I” (incomplete) and “M” (missing) grades are removed, and the removal must be completed at least three weeks before the date of graduation, regardless of whether the course is included on the student’s Plan of Studies

The program of studies must be completed within a minimum of two and a maximum of three calendar years.

PROGRAM DESCRIPTION

To graduate, students must complete a minimum of 40 credit hours, including 8 credit hours of the two core courses, 4 credit hours of Graduate Seminar, 8 credit hours of Electives, and 20 credit hours of Research and Thesis.

Required Courses

PHSC 5101	Advanced Pharmaceutical Sciences I	4 credits
PHSC 5102	Advanced Pharmaceutical Sciences II	4 credits
PHSC 6000	Graduate Seminar	2 credits
PHSC 5000	Laboratory Rotations	2 credits
PHSC 6999	Research and Thesis	5 credits

Elective Courses

PHSC 6101	Novel Dosage Forms	4 credits
PHSC 6102	Advanced Physical Pharmacy	4 credits
PHSC 6103	Product Development	4 credits
PHSC 6201	Advanced Pharmacokinetics	4 credits
PHSC 6301	Neuropharmacology	4 credits
PHSC 6302	Advanced Pharmacology	4 credits
PHSC 6401	Advanced Immunology & Molecular Biology	4 credits
PHSC 6501	Structure Activity Relationships	4 credits
PHSC 6601	Cosmetics	4 credits
PHSC 6701	Advanced Toxicology	4 credits
PHSC 6801	Biostatistics	4 credits
PHSC 6901	Research Techniques: Theory and Practice	4 credits
PHSC 5990	Directed Readings	1-4 credit(s)

Example Degree Schedule

Semester	Course	Credits
Fall, Year 1	Adv. Pharm. Sci. I	4
	Graduate Seminar	2
	Research	5
Spring, Year 1	Adv. Pharm. Sci. II	4
	Graduate Seminar	2
	Research	5
Summer	Paid Summer Research	No Credits
Fall, Year 2	Elective I	4
	Graduate Seminar	2
	Research/Thesis	5
Spring, Year 2	Elective II	4
	Graduate Seminar	2
	Research./Thesis	5
	Total	44

Transfer Credit

A maximum of 10 graduate credits in which the student has earned an “A” from an equivalent program from another university will be honored towards the MS in Pharmaceutical Sciences for students transferring into Western U. The Department must approve all transfer credit, and the decision of the department is final.

COURSE DESCRIPTIONS

PHSC 5000 Laboratory Rotations 2 credit hours (Graded)

Assigned laboratory experiences introducing students to the research techniques and protocols under the guidance of faculty members in the Department of Pharmaceutical Sciences.

PHSC 5101 Advanced Pharmaceutical Sciences I 4 credit hours (Graded)

This course covers a wide range of topics such as immunology, pharmacology, biostatistics and toxicology. Some laboratory safety and research techniques will also be discussed in the course.

PHSC 5102 Advanced Pharmaceutical Sciences II 4 credit hours (Graded)

This course covers a wide range of topics in advanced pharmaceutical sciences such as pharmaceuticals, biopharmaceuticals, biotechnology, pharmacokinetics, drug metabolism and transport, and pharmacogenetics.

PHSC 5990 Directed Readings 1 credit hour (Graded)

Selected study of topics in the pharmaceutical sciences. Repeatable to a maximum of 4 credit hours.

PHSC 6000 Graduate Seminar 1 credit hour (Cr/NCR)

Required of all MS in Pharmaceutical Sciences students. Repeatable to a maximum of 4 credit hours

PHSC 6101 Novel Dosage Forms 4 credit hours (Graded)

This course covers the theoretical basis and design of controlled release and site specific drug delivery systems such as transdermals, microspheres, liposomes and monoclonal antibodies.

PHSC 6102 Advanced Physical Pharmacy 4 credit hours (Graded)

Application of physiochemical principles in the evaluation of pharmaceutical systems, preformulation, and drug transport.

PHSC 6103 Product Development 4 credit hours (Graded)

This course covers the formulation, evaluation and actual manufacture of pharmaceutical products.

PHSC 6201 Advanced Pharmacokinetics 4 credit hours (Graded)

This course covers pharmacokinetic and pharmacodynamic principles and methods used to study absorption, distribution, metabolism and excretion of drugs.

PHSC 6301 Neuropharmacology 4 credit hours (Graded)

Neuropharmacology principles will be introduced and integrated with experimental applications. Course topics include chemical and electrical transmission, neurotransmitter chemistry, neuroreceptor pharmacology and signal transduction mechanisms, structure and function of ion channels and ligand binding sites, synaptic plasticity, and an introduction to electrophysiology. Relevant and recent primary literature articles will be introduced for reading and subsequent group discussion.

PHSC 6302 Advanced Pharmacology 4 credit hours (Graded)

This advanced elective will address concepts and principles of neuronal identify and function that are germane to pharmaceutical sciences. Principles will be introduced followed by experimental applications. The course will integrate molecular, cellular, and behavioral concepts when applicable. Course topics include chemical and electrical transmission, neurotransmitter chemistry, neuroreceptor pharmacology and signal transduction mechanisms, structure and function of ion channels and ligand binding sites, synaptic plasticity with an introduction to electrophysiology. Relevant and recent primary literature articles will be introduced for reading and subsequent group discussion.

PHSC 6401 Advanced Immunology and Molecular Biology 4 credit hours (Graded)

This advanced elective will address concepts and principles of molecular biology and immunology with an emphasis in molecular neuroimmunology. Topics will include cells, organs and effector systems involved in both cell-mediated and humoral-mediated immune activity. Time will be spent looking at regulatory interactions among different components of the immune system and the deleterious effects of aberrant immune processes. Principles will be introduced, followed by experimental applications. Relevant and recent primary literature articles will be introduced for reading and subsequent group discussion.

PHSC 6501 Structure Activity Relationships 4 credit hours (Graded)

This course broadly reviews the area of structure-activity relationships wherein chemical changes on drug molecules are correlated with the pharmacodynamic effects of drugs. The focus is on quantitative structure-activity relationships (QSAR) using physicochemical, topological and molecular orbital approaches.

PHSC 6601 Cosmetics 4 credit hours (Graded)

This course covers the formulation, evaluation and regulation of cosmetics, skin care products, shampoos, dentrifices, antiperspirants, sunscreens, decorative cosmetics and preservatives.

PHSC 6701 Advanced Toxicology 4 credit hours (Graded)

This course will focus on the principles of toxicology and mechanisms of toxicity. Toxicology is the study of poisons. Examples of major toxic spills and human exposures will be discussed to illustrate the major adverse health effects associated with environmental toxins.

PHSC 6801 Biostatistics 4 credit hours (Graded)

This course will cover various topics in descriptive and inferential statistics intended to introduce the student to the theoretical and practical aspects of statistics in research. Various topics will include central tendency, variability, hypothesis testing, multi-factorial analysis of variance, trend analysis, regression analysis and correlation.

PHSC 6901 Biostatistics 4 credit hours (Graded)

This elective course will provide in-depth lectures addressing a wide variety of biochemical, pharmacological, physiological, behavioral, immunological and histochemical research methods as well as their application in basic science research and research that focuses on drug discovery. Cutting-edge or

breakthroughs in research technologies will also be covered. The ultimate goal is to provide graduate students with the theoretical framework for understanding the most widely used research methods.

PHSC 6999 Research and Thesis

1-5 credit hours (CR/NCR)

Supervised research experiences for preparation of the thesis. Repeatable to a maximum of 20 credit hours.

Academic Calendar 2011-2012

MSPS PROGRAM

(subject to change)

Monday, Aug. 8, 2011
Classes begin

Monday, Sept. 5, 2011
Labor Day

Monday, Oct. 10, 2012
Columbus Day

Wednesday, Nov. 23, 2011 (5:00 pm)
Thanksgiving recess

Monday, Nov. 28, 2011
Classes Resume

Friday, Dec. 16, 2011
Last Day of Classes, Autumn Semester

Monday, Jan. 2, 2012
Spring Semester Classes begin

Monday, Jan. 16, 2012
Martin Luther King Day

Monday, Feb. 20, 2012
Presidents Day

Thursday, May 17, 2012
Commencement

Friday, May 25, 2012
Last Day of Spring Semester

Monday, May 28, 2012
Memorial Day